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Studies In Motor Learning Of Gross Bodily Motor Skills

By D. K. Brace
University of Texas
Austin, Texas

THE study being reported is one of a series in which the general purpose has been to try to identify traits responsible for individual differences in ability to learn motor skills involving more or less total bodily activity. The procedure followed has included selecting physical performances (called learning tests) which involve general body coordinations, securing scores on the learning tests made during a series of 90 repeated trials, computing percent of improvement or learning, by two special methods, and correlating the amount of learning with various physical tests.

The subjects were 100 junior high school girls.

Six learning tests were used, of which four could be classified as of sport type, one of stunt type, and one of motor-rhythm type, as follows:

1. The Tangle. This is a stunt-type performance involving balance control and dexterity. It involves regaining the feet from a prone position with the legs crossed and feet held by opposite hands. From this position the subject must roll to the back, sit up, stand, and uncross the legs without releasing the hands. Score on the test was the number of trials required to perform the stunt correctly.

2. Rhythm test. The test involved performance of a "dance" step using arm and leg movements, devised for this purpose, and done to rhythm. The score was the number of trials required to perform the step correctly.

3. Wall Volley. The test involved bouncing a volleyball against a wall, and was scored in terms of the number of consecutive bounces up to 10 that could be made on each of 30 different trials.

4. Ball bounce. This test required the subject, while standing in a six-foot circle, to bounce a volleyball on the side of a baseball bat. The score was the number of bounces made on each of 30 trials.

5. Kick Test. In this test a soccer ball was kicked, indoors, at a rectangular target on a wall 30 feet away. Thirty trials, each of which involved three kicks, were allowed.

6. Target toss. This involved tossing a basketball over a net, 8½ feet above the floor so that the ball would fall on a target on the

floor on the other side of the net. Thirty trials of three tosses each were allowed, with the score being recorded for each trial.

These tests were devised so as to sample eye-hand-foot and general bodily coordinations in movements involving gross bodily activity of a sort that had not been previously practiced specifically as such. The wall volley, ball bounce, kick, and target toss tests involve coordinations typical of sports and may be referred to as sport-type tests. The assumption is that those girls having the greatest ability to learn the sorts of motor skills involved would make most improvement. Scores on all tests were converted into standard scale scores using the *T* scale technique.

Reliability of the four sport-type learning tests are shown in the following table.

TABLE I

RELIABILITY COEFFICIENTS OF LEARNING TESTS

	First 6 trials		*Total 30 trials*	
Learning test	*r*	*P.E.*	*r*	*P.E.*
Wall Volley	.614	.042	.863	.017
Kick Test	.227	.064	.519	.049
Ball Bounce	.504	.050	.805	.024
Target Toss	.605	.043	.775	.027

Reliability of the stunt-type and rhythm-type learning tests was not established because of the nature of the tests, and must be assumed in terms of the tests themselves.

It will be noticed that the wall volley, ball bounce, and target toss tests had good reliability when computed on the basis of 30 trials but only fair reliability when computed on the basis of the first 6 trials. Because percent of improvement involved use of scores on the first 5 trials as an initial score, results must be interpreted in light of these reliabilities. The low reliability of the kick test warranted eliminating this test in some parts of the study.

METHOD OF SCORING IMPROVEMENT

Three methods of scoring the learning taking place in the "learning tests" were used. The tangle and rhythm tests were of such a nature that the only score that could be used was the number of trials required to perform the test correctly. Scores on all these tests indicate a wide range of individual differences.

Three methods of scoring the other four tests were: (1) the total score on all 30 trials; (2) "the percent of possible gain method," namely, the percent that the actual gain, after the first five trials, was of the possible gain after the first five trials; and (3) "the difference in percent of gain method," namely, the difference between the percent of the total possible score made on the first five trials and the percent that the score on the final five trials is of the remaining possible score before the last five trials (this may be expressed also

as the difference between the initial percent of gain and the final percent of gain).

Percent-of-Possible-Gain Method of Scoring Learning Tests

This method of scoring involves obtaining:

1. The maximum possible score that could be made on a given learning test, for example, 300.

2. The score made on the first five trials called the initial score, for example, 15.

3. The total score on all trials, for example, 117.

4. The actual gain made after the first five trials, i.e., the total score made minus the score on the first five trials, for example, 117 — 15 = 102.

5. The maximum possible gain, i.e., the maximum possible score minus initial score, for example, 300 — 15 = 285.

6. The percent gain, i.e., the actual gain after the initial score divided by the maximum possible gain, for example, 102 ÷ 285 = 35.8 percent.

Difference-in-Percent-of-Gain Method of Scoring Learning Tests

The "difference-in-percent-of-gain method" interprets improvement or learning on the learning tests in terms of the difference between the percent that the actual score made at the beginning is of the maximum possible total score, and the percent that the final score is of the possible score remaining after the initial score and before the final score. The method uses the maximum score that could be made on all thirty trials in finding the percent that the initial score (score on first five trials) is of the possible maximum total score. The remaining possible score used in getting the percent that the actual score on the last five trials is of the possible remaining score was obtained by subtracting the score on the last five trials from the total score made on all thirty trials, and then subtracting this remainder from the total score possible on all 30 trials. This remaining possible gain was then divided into the actual score on the last five trials to give the percent that the score on the last five trials is of the remaining possible score. This method of determining the remaining possible score takes into consideration the sum of the actual scores made and therefore gives the subject credit for previous scores. The percent gain on the first five trials was subtracted from the percent gain on the last five trials, and this difference was used as the measure of learning taking place.

An illustration of the procedure is as follows: Subject A made an initial score of 15 on the first five trials. The total maximum possible score for one test on all 30 trials was 300. The percent that the initial score is of the maximum possible score was found by

dividing 15, the initial score, by 300, the maximum possible score, thus giving the percent of initial gain as 5.0. The total score on all 30 trials made by Subject A was 117; her final score was 19; the actual total score minus her final score was 117 minus 19, or 98. This 98 was then subtracted from the maximum possible score of 300, to obtain in this case, 202, which was used as the remaining possible score at the beginning of the last five trials. It will be seen that actually the possible score on the last five trials would be 60, but in order to include credit for all previous scoring the final remaining possible score was computed as explained above. The percent that the score on the last five trials is of the remaining possible score was then found by dividing the final score of 19 by the remaining possible score of 202, in this case, 9.4 percent. The next and final step was to obtain the difference between the percent of initial gain and the percent of final gain, or in the case of Subject A by subtracting 5.0 from 9.4 giving a difference of 4.4 percent, or, in other words, a score of 4.4. This was the learning score used in the method of scoring referred to as "the difference-in-percent-gain method."

This is a rather complicated method of scoring the amount of learning taking place. This method and several other percent procedures, however, were used by the author and Carpenter with other similar data and, by comparing coefficients of correlation between learning test data and various methods of scoring improvement, was selected as the best method of scoring.

The two methods of computing percent gain used in studies of motor learning by the author make possible expressing improvement (learning) in terms of a comparable measure, a percent. They also have the effect of neutralizing differences of initial ability because each learner's score is expressed in terms of the ratio of her actual improvement to the possible improvement that she could make following her initial five trials.

These methods of computing percent of gain in performance are believed to be a marked improvement over the customary method of dividing the gain by the initial score. By this customary method a beginner may appear to make a large gain merely because his initial score is low.

MEASURES CORRELATED WITH LEARNING SCORES

Learning scores computed by the different methods mentioned above were compared with certain standard tests by correlation. The standard test items were:

1. Brace motor-ability test.
2. Balance items in Brace test.
3. Agility items in Brace test.

4. Iowa Revision of the Brace test.

5. Athletic ability (measured by 3 tests comprising an athletic index).

6. Physical performance level tests (7 tests of physical fitness nationally approved for high school girls).

7. McCloy's general motor-ability score, general motor-capacity score, general motor-achievement quotient, and motor quotient.

FINDINGS

Inter-correlations between the learning tests were all low except in the case of the tangle with the rhythm test which correlated .601 ± .043.

Relationship between total scores on the six tests (total score method) and the individual tests are given in Table II.

TABLE II

RELATIONSHIP BETWEEN INDUSTRIAL LEARNING TESTS AND SUM OF SCORES ON ALL LEARNING TESTS

Learning Tests	*Sum of Scores on All Learning Tests (Total score method)*	
Tangle test	.377	.058
Rhythm test	.380	.057
Ball bounce	.698	.035
Target toss	.615	.042
Wall Volley	.731	.031

The sum of scores on the four sport-type learning tests, scored by percent-of-possible-gain method correlate with the tangle-plus-rhythm test .140 ± .066, but with the total scores on all six learning tests, .796 ± .046, thus indicating that motor learning of the stunt or rhythm type may differ from motor learning of sport-type skills.

A comparison of three methods of scoring motor learning is shown in Table III:

TABLE III

INTER-CORRELATION BETWEEN METHODS OF SCORING LEARNING

Methods of Scoring Learning	*Coefficient of Correlation*
Total score method vs. percent of possible gain	.796
Total score method vs. difference between initial and final percent gain	.554
Difference between initial and final percent of gain vs. percent of possible gain	.734

It would appear that of the two methods of computing percent of gain the percent-of-possible-gain method more nearly corresponds to the sum of all scores on learning trials (total score method) than does the other percent method.

The relationship of motor learning to measures of motor ability is shown in Table IV:

TABLE IV

MEASURES OF MOTOR ABILITY CORRELATED WITH MEASURES OF MOTOR LEARNING

Measures of Motor Ability	*Measures of Motor Learning (Sport-type skills)*	*Coefficient of Correlation*
Brace Motor Ability	Percent possible gain	.357
Brace Motor Ability	Difference between initial and final gain	.318
Brace balance items	Percent possible gain	.238
Brace balance items	Difference between initial and final gain	.483
Brace agility items	Difference between initial and final gain	.280
Iowa Revision of Brace Test	Difference between initial and final gain	.299
Iowa Revision of Brace Test	Brace Test	.707

Motor learning as measured in this study correlates more closely with the original Brace Motor Ability Test than with the Iowa Revision of the Brace test, but in neither case is the relationship sufficiently close to warrant classifying either the Brace test or the Iowa Revision as a test of motor educability (motor learning). This same finding has been borne out by other previous studies made by the writer.[1]

Motor learning as measured correlates substantially with athletic ability and with physical performance level tests as shown in the following table:

TABLE V

RELATIONSHIPS BETWEEN MOTOR LEARNING OF SPORT SKILL TYPE AND ATHLETIC ABILITY AND PHYSICAL PERFORMANCE LEVEL TESTS

Measures of Motor Learning	*Measures of Athletic Ability and Physical Fitness Tests*		
	Athletic index	*Athletic index plus jump and reach*	*Physical Fitness Tests*
Per cent of possible gain method	.667	.660	.567
Difference between initial and final percent gain	.553	.555	.500

From these findings it would appear that there is a substantial relationship between motor learning of the sport-skill type and athletic ability, and between such motor learning and physical fitness as measured by physical performance level tests. The relationship with athletic ability, however, is slightly closer than with physical fitness.

These findings substantiate those of previous studies in indicating that learning of gross bodily motor skills of the sport-skill type relates more closely to the qualities measured by tests of running speed, jumping, and throwing than with motor ability tests (the Brace test), or with other standardized tests proposed as measures of motor learning.[2]

1D. K. Brace, "Studies in the Rate of Learning Gross Bodily Motor Skills," *Research Quarterly*, 12; 2 (May, 1941).

2Brace, *loc. cit.*

Two of the six learning tests, the tangle and rhythm test, differed from the other four in that they involved performance of new coordinations not related to sport skills. The tangle involves dexterity and balance and calls for ability to analyze movement and make corrections in performance. The rhythm test calls for recognition of a movement pattern and "motor memory" in performance at a set rhythm. The learning scores on these two tests consisted of the number of trials required to master the movements.

The relationship between scores on the tangle and rhythm tests with scores on the sport-type learning tests* is very low as shown by a correlation of .140 ± .066 with learning measured by the percent-of-possible-gain method. The two tests have a self correlation of .601 ± .043. Both the tangle and rhythm tests have low correlations with three of the other four learning tests, as follows:

tangle	vs. ball bounce	= .128	± .066
tangle	vs. wall volley	= .132	± .066
tangle	vs. target toss	= .101	± .066
rhythm	vs. ball bounce	= .168	± .065
rhythm	vs. wall volley	= .106	± .066
rhythm	vs. target toss	= .124	± .066

The tangle and rhythm tests show lower correlations with other measures of general motor ability than do the sport-type learning tests.

From these findings, in conjunction with other results reported previously in this paper, it begins to appear that there may be a type of motor learning which functions in gross bodily activities involving throwing, batting, or kicking an object whch differs from motor learning involved in learning bodily movements not requiring control of an object by body coordinations. If this is true it may explain the closer relationship between motor learning of sport-type skills and athletic ability and "physical fitness" tests.

AN ANALYSIS BY PARTIAL AND MULTIPLE CORRELATION TO SHOW AN APPARENT DIFFERENCE IN TYPES OF MOTOR LEARNING

Further substantiation of the writer's belief that there are at least two types of motor learning is obtained from partial and multiple coefficients of correlation obtained for four variables, namely:

1. Motor learning of sport-type skills (scored by the percent-of-possible-gain method).

2. Motor learning measured by the tangle plus the rhythm learning tests.

3. The Brace motor-ability test.

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* Correlation with the kick test was not computed because of low reliability of the latter.

4. Athletic index (50-yd. dash + basketball throw + standing broad jump).

For these four variables the zero order coefficients of correlation are:

r 12 = .140	r 23 = .465
r 13 = .357	r 24 = .288
r 14 = .667	r 34 = .533

Partial coefficients of correlation are:

r 12.3 = —.031	r 23.4 = .384
r 13.2 = .346	r 24.1 = .264
r 13.4 = .002	r 24.3 = .180
r 14.2 = .749	r 34.1 = .425
r 14.3 = .603	r 34.2 = .460
r 23.1 = .450	
r 12.34 = —.270	r 23.14 = .399
r 13.24 = .003	r 24.13 = .090
r 14.23 = .708	r 34.12 = .356

Coefficients of multiple correlation of significance are:

R 1.23 = .370
R 1.34 = .667
R 1.234 = .756

It will be seen that motor learning of sport-type skills has practically no relationship to motor learning as measured by the tangle and rhythm tests (stunt-type tests); and that as the Brace test and athletic index are partialed out the relationship even becomes negative.

The relationship between sport-type learning and athletic index increases from .667 to .749 when the stunt type learning is partialed out. This high degree of relationship between motor learning of sport-type skills and an athletic index made up of a sprint, a throw, and a jump is highly significant.

The relationship between the Brace test and motor learning of sport-type skills drops from .357 to .346 to zero when the stunt-type learning scores and the athletic index are partialed out. This would appear to indicate that the relationship of the Brace test to sport-type learning is due to those parts of the test which measure speed, strength, and power. This is further shown by the fact that relationship between the Brace test and athletic index remains about the same regardless of the effect of the other two variables, a relationship varying from .356 to .533. Likewise the relationship between the Brace test and the tangle and rhythm learning tests remains fairly constant, varying from .465 to .384, and is at its lowest when the athletic index only is partialed out.

The multiple correlation between sport-type motor learning and the Brace test and athletic index of .667 is raised to .756 when the tangle and rhythm learning tests are added. The best combination

of the tangle and rhythm tests with the Brace test produces a multiple correlation of only .370.

The results of this analysis of partial and multiple coefficients lead the writer to feel confident that we can distinguish at least two types of motor learning, and should suspect the existence of still other types. One type of ability to learn gross bodily motor skills is referred to by the writer as "sport type" learning. This type of learning relates to performances involving the use of speed, strength, power, and dexterity in manipulating the body in control of some object such as a ball. There is a close relationship between this type of learning and fundamental measurements of speed, strength, and skill. Although the relationship is close, however, an adequate measure of ability to learn sport-type skills will involve supplementing measurements of such fundamental qualities as speed, strength, power, and dexterity with other measures not yet adequately identified. A revision of the Brace-type test of motor ability to eliminate items which reduce the correlation between sport-type learning tests and the fundamental qualities named above should produce a higher multiple correlation than the one reported here.

The performance of gross bodily motor activities required in daily living involves performances of the stunt type, namely, the manipulation of the body without relation to the control of some object or of a marked use of strength, speed, or power. Ability to learn such performances cannot be adequately measured by tests so far proposed, judged by the results of this and similar studies previously reported. The writer believes that the best approach yet made to this problem is the use of stunt-type tests.

RELATIONSHIP OF MOTOR LEARNING TO COMBINATIONS OF TESTS PROPOSED TO MEASURE GENERAL MOTOR CAPACITY AND GENERAL MOTOR ABILITY*

Certain combinations of physical tests have been proposed by McCloy as measures of general motor capacity including ability to learn motor skills.** Other combinations have been proposed such as general motor-ability score, general motor-achievement quotient, and motor quotient.

The items in these measures are:

1. General motor-capacity score = 3.516 (Sargent jump in cms.) + 2.20 (Brace test T score) + 19.12 (Burpee test) + 119.
2. General motor ability = .42 (total points of dash, broad jump, and throw) + 9.6 number of chins (pull-ups).

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* From a study by Mrs. Geraldine Burch, unpublished thesis for M. Ed. degree, University of Texas, 1945.

** C. H. McCloy. *Tests and Measurements in Health and Physical Education.* New York: F. S. Crofts and Company, 1939.

3. General motor-achievement quotient = general motor-ability score ÷ general motor-capacity score.
4. Motor quotient = general motor-capacity score ÷ norm for general motor capacity (by age).

The relationship between motor learning and the measures proposed by McCloy as measures of general motor capacity, general motor ability, general motor-accomplishment quotient, and motor quotient are shown in the following table:

TABLE VI

RELATIONSHIP BETWEEN MOTOR LEARNING AND MCCLOY MEASURES OF GENERAL MOTOR ABILITY AND CAPACITY

Measures of motor learning or related tests	*General Motor-Ability Score*	*General Motor-Capacity Score*	*General Motor-Achievement Quotient*	*Motor Quotient*
Total learning score	.468	.488	.339	.477
Difference between initial and final percent gain	.436	.430	.431* .274	.435
Tangle plus rhythm	.256	.318	.245	.312
Brace motor ability	.....	.674** .653	.....	.658
Gain on physical performance levels (omitting potato race, pull-ups, 30-sec. squat thrust)	.....	.....	.086	.003
Physical performance levels	.704	.595	.578	.760
General motor-ability score	.....	.618	.953	.....
General motor-capacity score	.....	.....	.....	.861

* Using different pull-up scores.

** With Iowa revision + jump and reach + Burpee.

From the data in Table VI it would appear that the McCloy measures do measure learning of "sport type" motor skills to some degree, but not to a degree that would warrant using any of the measures of general ability as measures of motor learning (as measured in this study). The relationship with motor learning as evidenced in the tangle and rhythm tests is quite low.

The relationship between the McCloy measures and the physical performance levels is substantial, ranging from .678 to .760. The findings appear to indicate that the McCloy measures test strength, speed, agility, and power to a greater extent than they test ability to learn even the sport-type motor skills.

These findings do not necessarily detract from the merit of the McCloy measures of general motor capacity but they do indicate to the writer that the general motor-ability score, the general capacity score, general motor-accomplishment quotient, and the motor quotient do not justify being referred to as measures of motor learning. None of these measures should be used to predict ability to learn gross

bodily motor skills, and could, therefore, hardly be used to predict capacity for learning.

It will be noted that the correlation between learning ability, as measured in this study, and athletic ability is higher, with each method of computing learning, than is the correlation between motor learning and the McCloy measures of general ability.

SUMMARY OF FINDINGS

Four "sport type" learning tests were given to 100 junior high school girls to measure their ability to learn a variety of gross bodily motor skills in a designated number of trials involving 90 performances in each test. Two additional learning tests requiring mastery of complex coordinations were given to the same subjects and measured in terms of the number of trials required for mastery.

Two methods of computing percent of gain (learning) which had the effect of neutralizing initial differences in ability were used.

The relationship between motor learning, and tests of athletic ability, physical fitness, motor ability, and certain measures proposed as measures of general motor capacity (including motor learning) were studied.

Findings appear to warrant the following conclusions:

1. There are marked individual differences in ability to learn gross bodily motor skills.

2. The learning of "sport type" skills involves somewhat different abilities from those required to learn to manipulate the body in stunt-type or rhythm-type coordinations.

3. Ability to learn "sport type" motor skills is related rather closely to athletic ability and to speed, strength, agility, and power, and very little to ability to learn stunt-type skills.

4. The Brace motor-ability test does not measure motor learning to an extent that would justify the test being classified as a test of motor educability.

5. The Brace test is slightly superior to the Iowa revision of the Brace test as a measure of motor learning.

6. Certain measures proposed to measure motor learning, namely, the general motor-ability score, general motor-capacity score, general motor-accomplishment quotient, and motor quotient do not appear to measure motor learning to a sufficient extent to be used to predict motor learning, as measured in this study.

7. Because of its low relationship with motor learning there is grave question of the validity of the McCloy general motor-capacity score as a measure of motor capacity, if such capacity is understood to involve ability to learn.

8. Of the two methods used for computing percent of learning the percent-of-possible-gain method relates rather closely to the total achievement recorded on the learning tests, and rather closely to athletic ability and to physical fitness.

9. The method of computing learning which is referred to as the difference between initial and final percent of gain relates more closely than does the other percent method to performances involving balance and less closely to athletic ability and physical fitness.

10. Further research is needed on methods of computing percent of learning taking place, and study of different types of motor learning.

11. Perhaps the greatest contribution of this study has been to indicate that there are probably different types of motor learning, and that motor learning of "sport type" skills is dependent to a considerable extent upon physical fitness expressed in terms of strength, speed, agility, and power.

Some Notes On Differential Actions Of Partite Muscles

By C. H. McCloy
State University of Iowa
Iowa City, Iowa

MANY muscles of the human body are composed of several parts, functionally speaking, all attached to the same bone and, some of the time, all working together. Some of these muscles, such as the triceps brachii, the biceps brachii, the quadriceps femoris, and the deltoid, are inserted into one tendon. The quadriceps is also inserted into both sides of the capsule of the knee. Here, obviously, the vastus medialis pulls on the inner side of the capsule and the vastus lateralis on the outer side of the capsule. Other muscles, such as the trapezius and the serratus anterior, are distributed over a wider range than the above-mentioned muscles and may not always pull on all the parts of the insertion at one time.

Probably all kinesiologists have assumed differential actions of the parts of these muscles. These assumptions, most of them probably correct, have been based largely on palpation of the muscles during the actions concerned. To check the validity of these assumptions, and to stimulate objective studies in the field of muscle kinesiology, the author, with the assistance of Arthur Slater-Hammel, studied the actions of some of these muscles by means of action current recordings.

A two-outlet action current apparatus, which had been set up by Slater-Hammel in connection with an extensive study of muscle actions in certain sports activities, was utilized for the present study, with Slater-Hammel at the controls. The apparatus used was similar to that described in a publication by A. W. Hubbard.[1]

Five muscles were studied: the deltoid, the triceps brachii, the pectoralis major, the trapezius, and the quadriceps femoris.

The recordings were made on a long roll of paper six inches wide. The first two recordings represent the action of the muscles over which the electrodes were placed, and the third recording represents the time line, with recordings in fiftieths of a second. In this study the time line is relatively unimportant. The subject (the author) performed the indicated exercises, and the results were recorded.

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[1]Alfred W. Hubbard, "An Experimental Analysis of Running and of Certain Fundamental Differences between Trained and Untrained Runners," *Research Quarterly*, 10:3 (October, 1939), 28-38.

The heights of the recordings of the action currents are not exactly indicative of the relative strengths of the contractions of the muscles, but the *height of each recording* is highly correlated with the relative strength of contraction of that muscle. The recordings of the two muscles were, however, calibrated on the machine as closely as possible and hence should be roughly comparable.

Experiment No. 1.—Electrodes were placed over the anterior deltoid (clavicular part) and over the middle deltoid. The arm, with the hand holding a fifteen-pound dumbbell, was raised (a) forward, (b) diagonally forward-sideward, and (c) sideward.

a. Arm raised forward, palm up. There was strong contraction of the anterior deltoid and moderate to weak contraction of the middle deltoid (see Figure I*). The recordings were the same with the palm down, hence no figure will be shown.

b. Arm raised diagonally forward-sideward. There was strong contraction of the anterior deltoid and moderate contraction of the middle deltoid. The contraction of the middle deltoid was greater than in the arm raised forward but not as great as the contraction of the anterior deltoid itself (see Figure II). The recordings were the same with the palm down.

c. Arm raised sideward. The major contraction was still in the anterior deltoid, and the relationship of the contraction of the anterior deltoid with that of the middle deltoid was about the same as that with the arm raised diagonally forward-sideward (see Figure III).

Experiment No. 2.—The electrodes were placed over the posterior deltoid and over the middle deltoid.

a. Arm raised forward. There was no observable contraction of the posterior deltoid, but there was considerable contraction of the middle deltoid (see Figure IV).

b. Arm raised diagonally forward-sideward. There was no observable contraction of the posterior deltoid. There was a slightly greater contraction of the middle deltoid than in the movement forward (see Figure V).

c. Arm raised sideward. There was no observable contraction

* Figures will be found at end of article.

of the posterior deltoid, but there was considerable contraction of the middle deltoid. Since recordings are the same as that for the arm raised diagonally forward-sideward, no figure is given.

d. Arm raised diagonally backward-sideward. There was a strong contraction of the posterior deltoid and of the middle deltoid. The contraction of the posterior deltoid seems to initiate the movement and then ceases. The middle deltoid continues to contract during the entire movement (see Figure VI).

e. Arm raised backward. There was a strong contraction of the posterior deltoid and a marked contraction of the middle deltoid as well. The middle deltoid comes into the movement later than the posterior. The contraction of the posterior deltoid initiates the movement, and the middle deltoid comes in about two-fifths of the way after the beginning of the movement. Both parts contract from there on. It looks as though the middle deltoid began to contract at about the peak of the movement and remained in action during the relaxation (see Figure VII).

Experiment No. 3.—Triceps brachii. Electrodes were placed over the medial head of the triceps and over the long head. (It will be recalled that the long head is inserted below the glenoid fossa of the scapula and hence should be concerned with any extension downward or backward of the upper arm in the shoulder joint, as well as with straightening the elbow.)

a. The subject stood with a fifteen-pound dumbbell in the hand and with the trunk bent forward about forty-five degrees. The elbow was extended sharply and the arm raised backward and *away from* the medial line about forty degrees. The medial head was contracted strongly, and the long head was contracted but not as strongly as the medial head (see Figure VIII).

b. From the same position as in *a*, the elbow was extended and the arm raised backward and *toward* the medial line, with the upper arm pressing against the latissimus. There was almost no apparent contraction of the medial head but a marked contraction of the long head (see Figure IX).

Experiment No. 4.—Pectoralis Major. The subject had noticed something which has apparently escaped the attention of most kinesiologists, namely, that when the arms are raised sideward and upward, as soon as the arms reach the side horizontal position, the upper part of the pectoralis major comes into contraction. Hence, in this experi-

ment, electrodes were placed over the upper or clavicular portion and over the lower part of the pectoralis major.

a. Arms swung sideward to diagonally sideward-upward. The upper or clavicular portion of the pectoralis major came into fairly strong contraction as the arms reached the side horizontal position and remained in contraction until they were lowered past it. No contraction was seen in the lower part (see Figure X).

b. The hands were placed together in front of the lower abdomen and pressed together hard, with the elbows out sideward. There was some action recorded in the upper pectoralis major but much more in the lower (see Figure XI).

c. With the hands together and raised above and in front of the forehead, the hands were pressed tight together again. In this case, the contraction was primarily in the upper pectoralis, and there was almost no evidence of contraction in the lower (see Figure XII).

Experiment No. 5.—One electrode was placed over the upper trapezius (Part I) and the second over the lower trapezius (Part IV). A head strap with a thirty-pound weight attached to it was hung on the head, with the body bent forward almost to a horizontal position. The experiment was to determine whether or not there was a difference in the action when the hands were hanging loose and when they were fixed. (This experiment was prompted by the fact that the upper trapezius runs from the occiput to the outer part of the spine of the scapula. It seems possible that this muscle might contract more strongly if the scapulae were fixed by the muscle actions related to pressing hard against the knees with the hands.)

a. In this part of the experiment the hands hung down loose, and the head and neck lifted the weight. The upper part of the trapezius contracted very strongly, and the lower part came in somewhat later—in this case a little over one-fifth of a second later (see Figure XIII).

b. The same experiment was tried with the hands on the knees. The recordings were almost the same as in *a*, with perhaps a slightly larger contraction of the lower trapezius (no figure shown).

c. With dumbbells in the hands, the arms were swung sideward and upward. Here the movement seemed to be initiated, so far as the trapezius was concerned, by the lower portion, and the upper portion came in hard a little later. Since in this exercise the scapula rotates actively outward, it is possible that the upper angle was held fairly

firm by the levator scapulae at the beginning of the movement and that the vertebral end of the spine of the scapula was pulled downward by the lower portion as the serratus anterior pulled the scapula forward. The upper part, however, came in strong in a short time (see Figure XIV).

d. The next exercise was shrugging the shoulders upward from a standing position and with the dumbbells in the hands. Here the upper portion of the trapezius came into violent action, with no contraction seen in the lower part (see Figure XV).

Experiment No. 6.—In this experiment electrodes were placed over the rectus femoris and over the vastus lateralis. It is assumed here, without proof, that the three vasti work together in the extension of the knee and that the action of one vastus (vastus lateralis) is accompanied by action in the other vasti. The attempt in this experiment was to separate the actions of the vasti and of the rectus.

a. In the first movement, the thigh was raised backward, but with strong straightening of the knee. There was almost no evidence of contraction of the rectus but there was a strong contraction of the vastus (see Figure XVI).

b. In this phase of the experiment, the leg was raised forward with strong extension of the knee. Both groups of muscles contracted strongly as would be expected (see Figure XVII).

These experiments are neither extensive nor conclusive, and the kinesiologist might well state that the experimenter found only what would be expected, which assumption is true. In the mind of the author, the significance of the experiment is that in the kinesiological writings there has not been an adequate attempt to distinguish between the actions of the various parts of many of the different muscles. It is suggested that the movements of limbs in various directions be analyzed, perhaps by palpation, much more than has been true in the past and that attempts be made to differentiate actions of the various parts of the muscles. It is hoped that further work will be done on a much larger scale, with the use of the action current technique. Some work of this type has already been done by Slater-Hammel,[2] and the science of kinesiology can profit by much more work of this nature.

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[2]Arthur T. Slater-Hammel, "Action Current Study of the Rectus Abdominalis as a Postural Muscle in Arm Movements," *Research Quarterly*, 14:1 (March, 1943), 96-105.

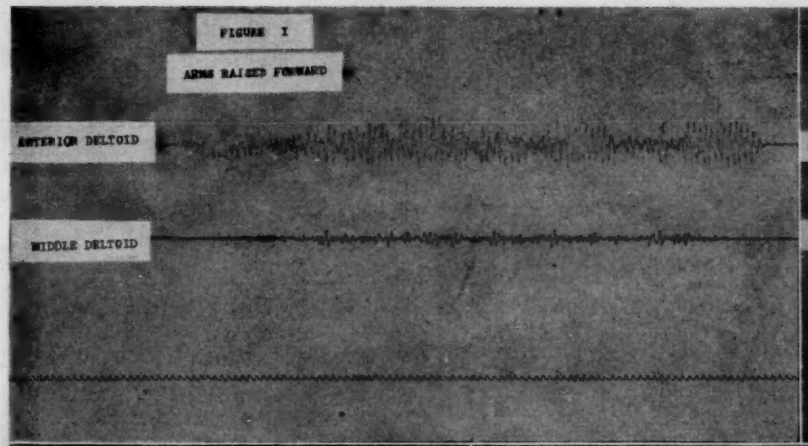
FIGURE I
ARMS RAISED FORWARD
ANTERIOR DELTOID
MIDDLE DELTOID

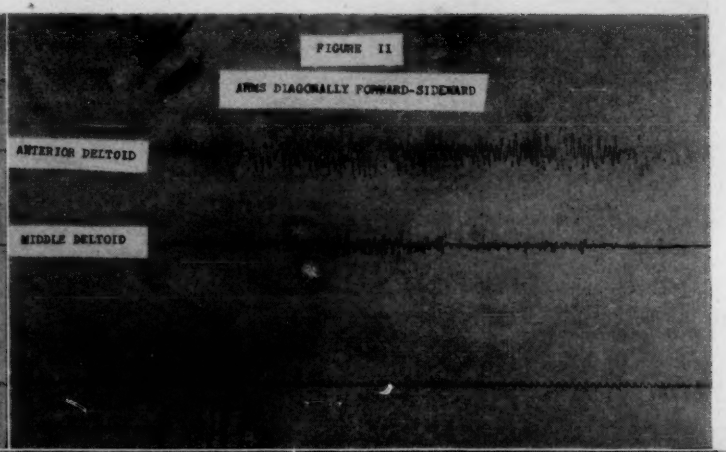
FIGURE II
ARMS DIAGONALLY FORWARD-SIDEWARD
ANTERIOR DELTOID
MIDDLE DELTOID

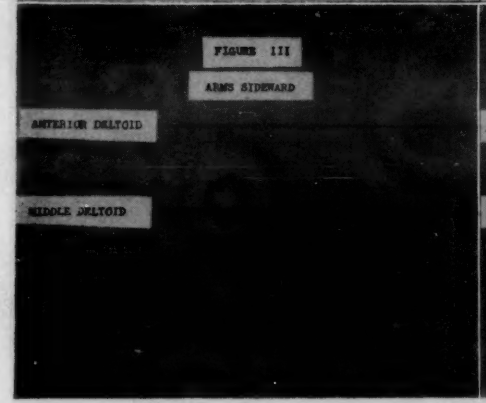
FIGURE III
ARMS SIDEWARD
ANTERIOR DELTOID
MIDDLE DELTOID

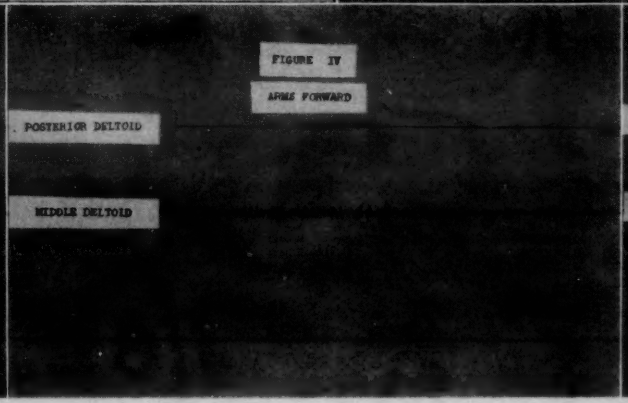
FIGURE IV
ARMS FORWARD
POSTERIOR DELTOID
MIDDLE DELTOID

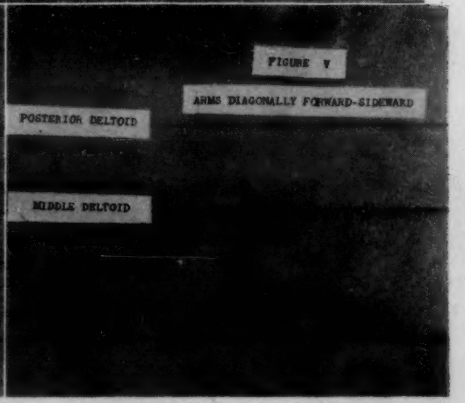
FIGURE V
ARMS DIAGONALLY FORWARD-SIDEWARD
POSTERIOR DELTOID
MIDDLE DELTOID

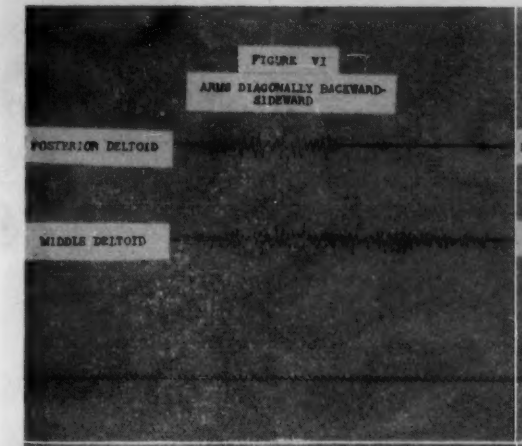
FIGURE VI
ARMS DIAGONALLY BACKWARD-SIDEWARD
POSTERIOR DELTOID
MIDDLE DELTOID

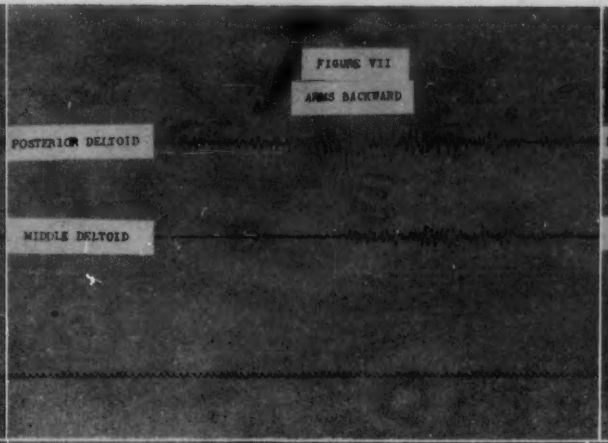
FIGURE VII
ARMS BACKWARD
POSTERIOR DELTOID
MIDDLE DELTOID

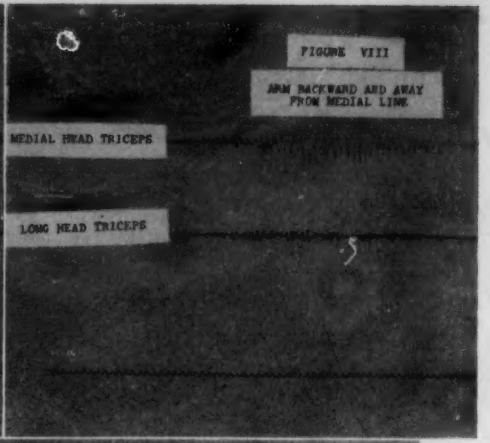
FIGURE VIII
ARM BACKWARD AND AWAY FROM MEDIAL LINE
MEDIAL HEAD TRICEPS
LONG HEAD TRICEPS

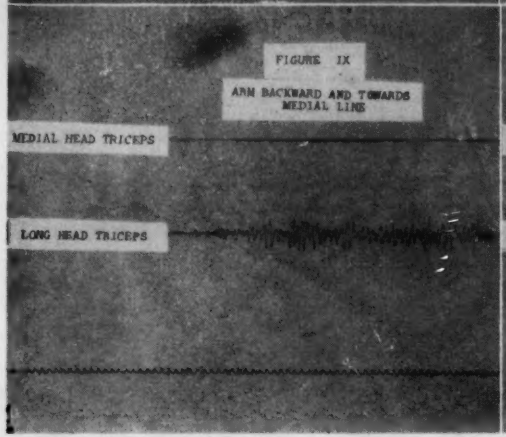
FIGURE IX
ARM BACKWARD AND TOWARDS MEDIAL LINE
MEDIAL HEAD TRICEPS
LONG HEAD TRICEPS

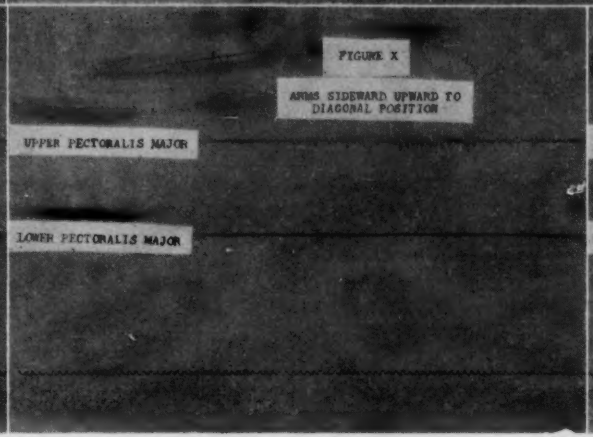
FIGURE X
ARMS SIDEWARD UPWARD TO DIAGONAL POSITION
UPPER PECTORALIS MAJOR
LOWER PECTORALIS MAJOR

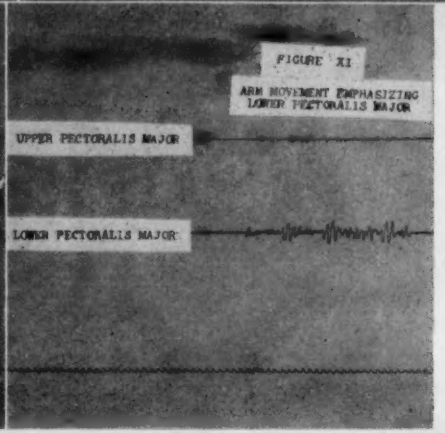
FIGURE XI
ARM MOVEMENT EMPHASIZING LOWER PECTORALIS MAJOR
UPPER PECTORALIS MAJOR
LOWER PECTORALIS MAJOR

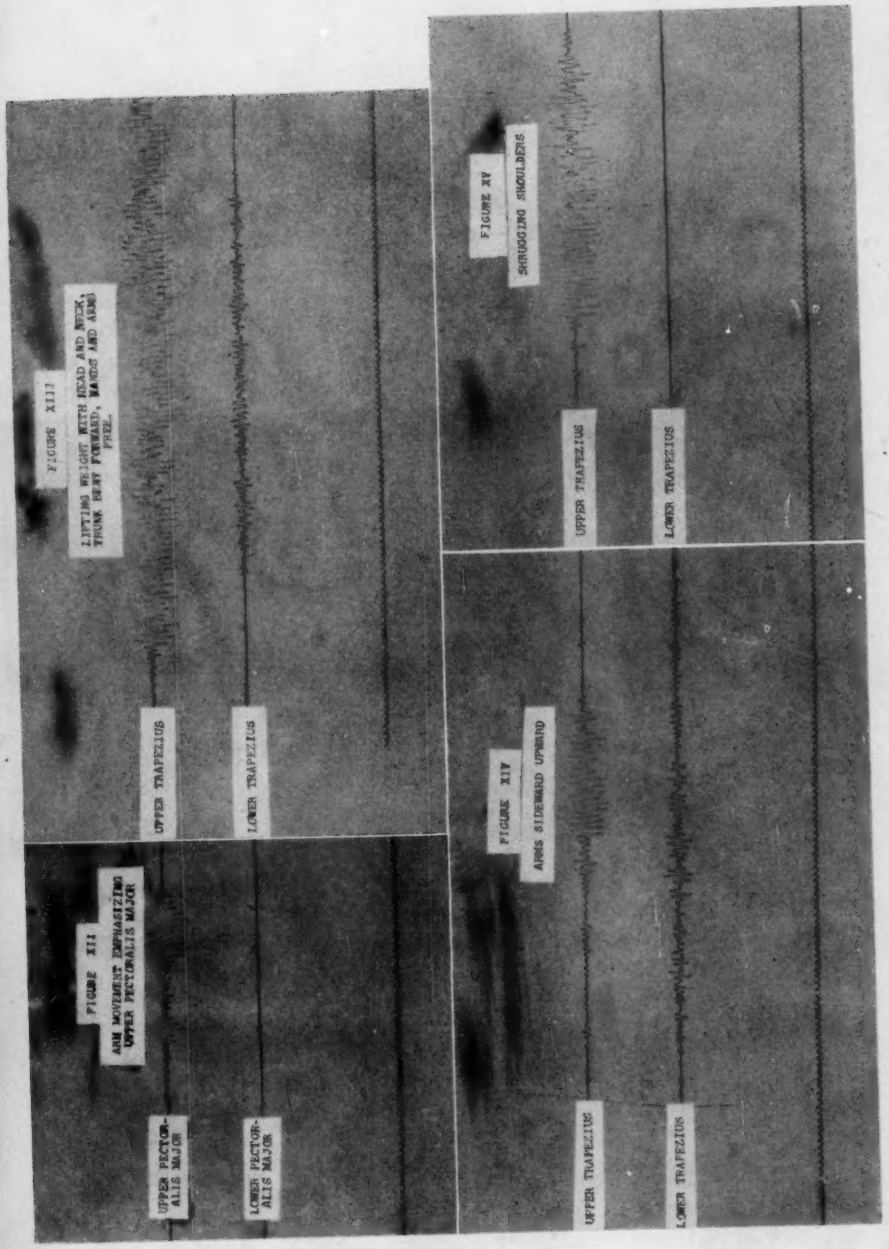
FIGURE XII
ARM MOVEMENT EMPHASIZING UPPER PECTORALIS MAJOR
UPPER PECTORALIS MAJOR
LOWER PECTORALIS MAJOR
FIGURE XIII
LIFTING WEIGHT WITH HEAD AND NECK; TRUNK BENT FORWARD, HANDS AND ARMS FREE.
UPPER TRAPEZIUS
LOWER TRAPEZIUS
FIGURE XIV
ARMS SIDEWARD UPWARD
UPPER TRAPEZIUS
LOWER TRAPEZIUS
FIGURE XV
SHRUGGING SHOULDERS
UPPER TRAPEZIUS
LOWER TRAPEZIUS

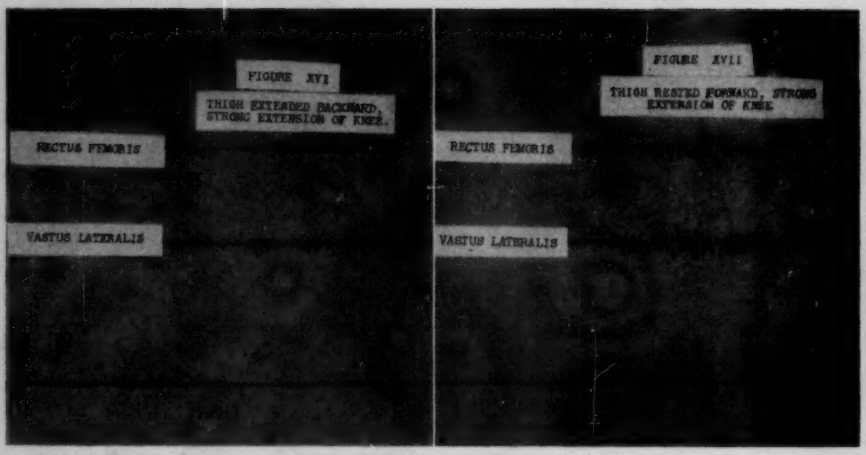
FIGURE XVI
THIGH EXTENDED BACKWARD, STRONG EXTENSION OF KNEE.
RECTUS FEMORIS
VASTUS LATERALIS
FIGURE XVII
THIGH RESTED FORWARD, STRONG EXTENSION OF KNEE
RECTUS FEMORIS
VASTUS LATERALIS

The Effect Upon Pulse Rate Of Various Cadences In The Step-Up Test

By Waldo A. Miller and Edwin R. Elbel
University of Kansas
Lawrence, Kansas

PURPOSE

In attempting to find a simple means of evaluating physical condition during the recent war there was a definite revival in the use of the various forms of the step-up test. While in a few instances this form of exercise was used merely for determining the physical endurance of the individual, it was most frequently used as a measure of the effect of a standard amount of physical work upon the heart rate. This was particularly true in certain of the Army Air Forces convalescent training programs in which this type of test was used to determine the patient's fitness for physical activity prior to his return to active duty.

This study was undertaken to supplement earlier work by determining the effect of various cadences upon the pulse rate while the duration of exercise and the height of the bench were kept constant.

REVIEW OF LITERATURE

In 1921 Hambly and Hunt experimented with the effect upon pulse rate of running and walking up and down stairs. Later (1922) this method was given up in favor of the step-up exercise in which a 13-inch step was used at cadences varying from 6 to 36 steps per minute. In an attempt to find two exercises, one which would produce a pulse-ratio below 2.5 and another, a ratio slightly above 2.5, Hambly, Pembrey, and Warner (1925) used the 13-inch step with a cadence of 18 and 24 steps per minute in order to compare various tests for assessing physical fitness. They concluded that, "For many reasons the pulse affords the best test of efficiency."

In 1925 Campbell conducted a study in which he used eighty medical students as subjects. Part of this number was made up of good athletes, while the remainder took no exercise whatsoever. He employed the technique of Hambly and Hunt, using a 13-inch step and a cadence of 28 steps per minute. Campbell concluded that his step test showed a greater difference between the unfit and the average men than between the average men and the athletes.

Tuttle (1931, 1938a, 1938b, 1938c, and 1942), using a modification of Hambly's technique, conducted numerous studies with the step test and devised the Pulse Ratio Test.

Schneider (1920) recommended the step-up on an ordinary chair at the rate of 5 steps in 15 seconds as a part of his suggested cardiovascular test.

Brouha (1943a, 1943b, and 1944) reported on work done on the step test in the Department of Hygiene at Harvard University. A step 20 inches in height and a cadence of 30 steps per minute were used in the test. The subject exercised for five minutes if not forced to stop prior to that time from exhaustion. Physical condition was evaluated by the use of prepared tables in which pulse response was scored on the basis of the duration of exercise.

Karpovich, Starr, and Weiss (1944) used the 20-inch step and a cadence of 24 steps per minute over a period of 30 seconds for evaluating the condition of patients in Army hospitals for participating in forms of mild physical activity. As the condition of the patient improved, at the discretion of the ward medical officer, his fitness for participating in more strenuous exercise was measured by his ability to perform the same type of exercise for a period of five minutes (if not forced to stop from exhaustion). His physical condition was evaluated by the pulse response and his ability to endure the exercise.

Elbel and Green (1946), using a standardized cadence of 24 steps per minute with steps 12, 14, 16, 18, and 20 inches in height during exercise periods of 30 and 60 seconds in duration, found that the pulse in the healthy male subjects taken one minute after exercise returned to approximately the pre-exercise level, regardless of the height of the bench, or whether the exercise was 30 or 60 seconds in duration.

PROCEDURE

Fifty-nine healthy male students at the University of Kansas were used as subjects for this study. The group included some of the members of the varsity basketball squad and members of physical education classes selected at random. Each subject was tested five times, once at each of the five cadences—18, 24, 30, 36, and 42 steps per minute. The cadence was set by a metronome. All tests were for a duration of one minute and in all cases the height of the step was 16 inches.

The height of 16 inches for the step was selected for several reasons. In the first place, it is a convenient height for most subjects. Elbel and Green showed that there was a relatively constant increase in pulse rate as the height of the step was increased. They also found that the height of the step did not significantly affect the pulse rate when taken for a period of 30 seconds starting one minute after exercise. Preliminary to this study it was found that a step of either

18 or 20 inches in height was not satisfactory for use with rapid cadences, since subjects were unable to maintain the rhythm toward the end of the one-minute period of exercise.

Preliminary to the first test each subject was given a uniform set of instructions. Before being tested each subject sat quietly for approximately ten minutes. The pre-exercise pulse rate was then taken. One experimenter did all of the testing. The set-up exercise was performed in the following manner: The subject stood before the step and at the starting signal stepped upon it with his left foot and, after coming to an upright position, placed his right foot beside the left on the step, and then stepped down with the left foot, finally bringing his right foot down beside his left. One complete cycle was considered a step. Arms were held loosely at the sides throughout the exercise. Immediately following the exercise the subject sat down on the step and remained in this position until the pulse was taken. The pulse was taken for 30 seconds before exercise; for 30 seconds starting 5 seconds after the conclusion of exercise, and again for 30 seconds beginning one minute following the exercise. Throughout this paper reference to the one-minute pulse rate means twice the number of beats for the period of 30 seconds starting one minute after exercise. The subject repeated the above procedure five times on five successive days, with the exception that a different cadence was used each day. The schedule was so arranged that testing was accomplished at the same hour on the successive days. In a few instances, due to conditions beyond the control of the subject, there were two or three days which elapsed between testing periods. In order to minimize the error which might have been introduced by following a definite sequence of testing, each subject performed the different cadences in random order.

RESULTS

The raw scores obtained in this study consist of pulse rates taken immediately before exercise, immediately following one minute of exercise, and beginning one minute after exercise for periods of 30 seconds. The 30-second counts were then doubled to secure the pulse rate per minute. Since five different cadences were used, there was a total of 15 raw scores for each of the 59 cases. The mean pulse rates are shown in Table I. An examination of these mean pulse rates shows that they were relatively uniform before exercise, ranging from 71.11 to 73.31. Immediately after exercise pulse rates increased to 93 or more beats per minute. The range was from 93.42 to 130.03. The increase was effected by the increase in cadence with the lowest pulse rate at the cadence of 18 steps per minute and the highest pulse rate at the cadence of 42 steps per minute. Examination of Table I shows that the increase immediately after exercise is fairly uniform

in that there was an average increase of approximately ten beats with each increase of cadence. The greatest mean difference in pulse rates between two cadences (11.6), was between the test using 24 steps per minute and the one using 30 steps per minute. The smallest mean difference (6) was found to be between the test using 36 steps per minute and the cadence of 42 steps per minute. The pulse rate immediately following the exercise was uniformly greater with the increase in cadence when compared with the pre-exercise rate. The average increase of pulse rate immediately after exercise per unit of increase in cadence was 9.15 beats per minute.

TABLE I

MEAN PULSE RATES BEFORE AND AFTER EXERCISE

Cadence	*Mean Resting Pulse Rate*	*Mean Pulse Rate Immediately After Exercise*	*Mean Increase Over Resting Pulse*	*Mean Pulse Rate One Minute After-Exercise*
18 steps per minute	73.70	93.42	19.72	67.66
24 steps per minute	71.89	102.6	30.71	68.09
30 steps per minute	73.11	114.21	41.10	75.23
36 steps per minute	73.31	124.38	51.07	82.11
42 steps per minute	71.11	130.03	58.92	95.66

The greatest difference between the pre-exercise pulse rate means and the mean rates taken one minute after exercise was found in that part of the study in which the most rapid cadence was used. The two slower cadences (18 and 24 steps per minute) show a pulse rate taken one minute after exercise to be lower than pre-exercise rate as indicated in Table II. The three faster cadences show that the pulse rate taken one minute after exercise was greater than the pre-exercise rate, with the greatest difference occurring after the most rapid cadences. In the case of the tests using 18 and 24 steps per minute the pulse rates taken one minute after exercise were significantly slower than the mean pre-exercise rates. In the cadence of 30 steps per minute the mean pulse rate taken one minute after exercise was found to be greater than the pre-exercise rate, but not significantly so. The mean pulse rates taken one minute after the exercise when the two most rapid cadences were used were found to be significantly higher than the pre-exercise rates. There is a range in the coefficient of variation from 12.5, in the case of the cadence of 24 steps per minute, to 16.18 in the test using a cadence of 42 steps per minute. Table II shows that the three tests using the faster cadences have definitely greater variation than the two using slower cadences. The cadence of 24 steps per minute shows the least variation and likewise the smallest standard deviation.

DISCUSSION

In comparing the results of this study with that done by Elbel and Green it will be noted that the pulse rate immediately after exercise is definitely increased by increasing the variable factor. In the study referred to, the variable factor was the height of the step and duration of exercise, while in this study it was cadence only. These two experimenters noted that in the use of steps varying in two-inch

TABLE II

STATISTICAL DATA

Cadence	*Mean*	*S.D.*	*Obtained Diff.*	*Standard Error*	*Critical Ratio*	*Chances in 100*	*Coefficient of Variation*
18—Before	73.70	10.80					
18—Immed.	93.42	10.19					
18—1 Min.	67.66	10.00	6.04	1.91	—3.16*	99+	14.79
24—Before	71.89	7.65					
24—Immed.	102.60	11.12					
24—1 Min.	68.09	8.52	3.80	1.48	—2.57*	99+	12.50
30—Before	73.11	9.24					
30—Immed.	114.21	12.10					
30—1 Min.	75.23	12.85	2.12	2.05	+1.03	85	17.08
36—Before	73.31	10.04					
36—Immed.	124.38	10.65					
36—1 Min.	82.11	13.26	8.80	2.15	+3.75*	99+	16.10
42—Before	71.11	9.96					
42—Immed.	130.03	10.15					
42—1 Min.	95.66	15.47	24.55	2.38	+10.31*	99+	16.18

* Significant.

increments from 12 to 20 inches in height, on the average the pulse rate returned to within ten beats of normal when taken for a 30-second period starting one minute after exercise. This was found to be the case in this study provided that the cadence of no faster than 30 steps per minute was used. The cadence of 24 steps per minute, which was the same as that used by Elbel and Green, and the one using 18 steps per minute were the only tests in which the pulse rates at the end of one minute after exercise returned to pre-exercise rate or below. The data for this study show that if a cadence greater than 30 steps per minute is used chances are very remote that the pulse rate taken one minute after exercise will return to the pre-exercise level. It should be noted that, if a test is desired in which the pulse rate taken one minute after exercise is equal to, or less than, the pre-exercise pulse rate, the cadence faster than 24 steps should not be used (for the 16-inch step). If a cadence of 24 steps or less is used, there is definite statistical assurance that the pulse rate taken one minute after exercise will be less than the pre-exercise rate. Tuttle suggested that the upper limit of cadence is about 60 complete steps per minute. It has been previously indicated in practical trials pre-

liminary to this study that when using the 16-inch step it was difficult for most subjects to maintain a cadence of 42 steps per minute for an entire minute. On the other hand, Tuttle used a step 13 inches in height.

Of the fifty-nine subjects used in this study two of them showed a pulse rate taken one minute after exercise to be below the pre-exercise pulse rate in all of the five cadences. They are mentioned only as special cases and no explanation is being attempted for their reaction to exercise.

SUMMARY AND CONCLUSION

1. In this study fifty-nine healthy male college students performed the step-up exercise on successive days at cadences of 18, 24, 30, 36, and 42 steps per minute. The duration of the exercise was for one minute for each cadence and each subject was tested five times, once at each of the five cadences. Pulse rates were taken prior to the exercise, immediately after exercise, and one minute after exercise for the purpose of determining the effect of cadence upon the pulse rate.

2. The pulse rate immediately following exercise increased on the average of 9.15 beats for each increase in cadence of six steps per minute.

3. After performing the exercise at a cadence of 18 or 24 steps per minute, the pulse rate taken one minute after exercise was on the average significantly lower than pre-exercise rate. The pulse rate taken one minute following exercise with cadences of 36 and 42 steps per minute was significantly higher than the pre-exercise rate. The pulse rate following the cadence of 30 steps was higher when taken one minute after exercise, but not significantly so.

4. The smallest coefficient of variation occurred in the test using 24 steps per minute.

5. The pulse rate for healthy male subjects following the step-up exercise on the 16-inch step with cadences of 18 or 24 steps per minute will, on the average, be slower one minute following exercise than the pre-exercise rate. Less variation in results will be experienced, however, when the cadence of 24 steps per minute is used.

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An Analysis Of The Mathematical Curves Underlying Some Physical Education Test Items

By Gerald Ehrlich
Department of Hygiene
City College of New York

PURPOSE OF THE STUDY

It is the purpose of this study to determine the extent to which certain data commonly encountered in physical education activities are normally distributed, and to attempt to characterize the mathematical curves of data that are not normally distributed.

ANALYSIS OF THE PROBLEM

The curve of normal distribution has been utilized for so many functions in educational and psychological measurement that its essential characteristics are frequently overlooked. Actually there is a subtle line of demarcation between concepts, one of which is a hypothesis, the other, a mathematical statement of chance. The former has as its premise the statement that data in biology, the natural sciences, education, and psychology *tend* to constitute curves of normal distributions. The latter on the other hand is a mathematical expression of probability of occurrence. Since one of the most important procedures in the collection of statistical data involves adequate and large sampling, it is but natural that investigators have assumed that their sources of data are derived from pure-chance situations and hence would follow a mathematical law of probability. Actually, there is no proof to indicate that data in various fields of education will yield a normal curve in every situation. Evidence from these fields, however, has given rise to very strong presumptions in favor of normal distributions. This attitude in turn has led to a questionable procedure, wherein any departure from a normal curve, whether such discrepancy consists of skewness or kurtosis, is assumed to be the fault of inadequate sampling, or that the sampling does not truly represent the traits or abilities of the group under investigation.

The writer questions the preceding situation on the basis that any preconceived assumption of normalcy of distribution is unwarranted and should be tested for statistical corroboration. A second point underlying the purpose of this paper concerns the relative obscurity of the backgrounds of many curves in physical education

data. This second point is related vitally to the construction of scoring tables using standard scores or some technique based upon standard scores. Such a method depends upon a fairly normal distribution for its efficiency. Essentially then, this study is to be considered as an exploratory attempt to characterize physical education data in terms of occurrence as normal or skewed curves.

LIMITATIONS OF THE STUDY

1. The sampling used in this study was drawn solely from the student population of the City College of New York, and included freshman classes only.

2. The items selected for investigation are those which have been used commonly in physical education test batteries and presumably measure factors of strength, muscular explosiveness, large-muscle coordination, agility, and speed. These items are chins, dips, standing broad jump, bar vault, running broad jump, leap test, bar snap, one-hundred yard dash, and the Cozens' maze run.

TREATMENT AND ANALYSIS OF THE DATA

Administration of the Test Items.—All test events were given according to standardized instructions by members of the faculty of the Department of Hygiene of the City College of New York, during the regular semester testing period. The collection of data covered a period of six semesters or three years, during which the number of cases for each item per semester varied between 123 and 252. All data were recorded on the standard cumulative student record card utilized by the department, except in the case of the bar snap, the leap test, and the Cozens' maze run. These items were administered and scored outside of actual class time. Table I indicates the total number of students for the entire period.

TABLE I

NUMBER OF SUBJECTS PARTICIPATING IN EACH EVENT DURING THE COLLECTION OF DATA

	1940		1941		1942		
Event	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Total*
Dips	169	172	133	156	162	127	919
Chins	168	179	127	162	149	134	919
Standing Broad Jump	168	175	128	160	149	131	912
Running Broad Jump	143	189	149	153	141	173	948
Bar Vault	152	167	153	142	—*	—*	614
Dash	176	123	142	163	—*	—*	604
Leap Test	—*	—*	176	143	152	167	638
Bar Snap	—*	—*	252	186	133	—*	571
Maze Run	—*	—*	250	177	148	—*	575
						Total	6700

* Not given during the semester.

Statistical Analysis.—The following statistical computations were completed for each one of the following: (a) measures of central tendency, (b) measures of variability, and (c) the Chi Square test for normalcy of distribution. The means and sigmas were not directly concerned with interpretations of normalcy or skewness but are herewith reported for purposes of completeness. These results are shown in Table II.

TABLE II

MEASURES OF CENTRAL TENDENCY, VARIABILITY, AND "P" VALUES FOR CHI SQUARE TEST

Event	*Mean*	*Sigma*	*"P" Value*
Dips	5.59	3.72	.072
Chins	4.81	2.85	.397
Dash (seconds)	14.41	0.93	.042
Vault (inches)	53.94	8.84	.034
Standing Broad Jump (inches)	85.32	9.27	.856
Running Broad Jump (inches)	144.27	36.58	.832
Leap Test (inches)	18.79	2.88	.936
Bar Snap (inches)	55.62	12.60	.438
Maze Run (seconds)	26.13	1.96	.265

Computation of the Chi Square yields an evaluation of the *form* of the distribution and enables one to state with statistical certainty whether the discrepancies existing between the theoretical normal curve and the obtained curve are due to fluctuations of random sampling or whether they may be attributed to some other inherent factor.[1] Inspection of the probability values reveals that any assumption of normality of distribution is unjustified for several of the items. Culler[2] has tabulated the opinions of a large number of statisticians with respect to the interpretations that may be made on the basis of the *P* values. According to this table the test items used in the study would be evaluated in the following way:

In interpreting the value obtained for dips one may say that the probability is 7.2 chances in 100 that we would obtain a fit as poor as the one obtained, or the chances are 92.8 in 100 that the fit would be better. Interpretations for the other events are then identical except for substituting the *P* values.

Inspection of the graph indicates that the logarithmic function applies in good fashion to these data. Furthermore the remaining items yielded logarithmic analyses equally as close.

1F. E. Croxton and D. J. Cowden. *Applied General Statistics.* New York: Prentice-Hall, 1939, p. 286.

2E. Culler, "Studies in Psychometric Theory," *Journal of Experimental Psychology,* IX (1926), p. 186.

TABLE III

EVALUATION OF PROBABILITY VALUES

Event	*"P" Value*	*Description*
Dips	.072	Poor
Chins	.397	Good
Dash	.042	Unacceptable
Vault	.034	Unacceptable
Standing Broad Jump	.856	Superlative
Running Broad Jump	.832	Superlative
Leap Test	.936	Superlative
Bar Snap	.438	Good
Maze Run	.265	Fair

In order to subject these data to a more rigid test for normalcy of distribution and to obtain further insight into the shapes of the curves, Pearson's Method of Moments was applied.[3] This technique yields certain constants that permit descriptions to be made on the basis of relative skewness, relative kurtosis, and normalcy of distribution. For a normal curve, the following conditions must prevail:

$B_1 = 0$ (skewness)
$B_2 = 3$ (kurtosis)
$K_2 = 0$ (normalcy)

The results of these computations are contained in Table IV.

TABLE IV

PEARSON'S METHOD OF MOMENTS APPLIED TO TEST ITEMS

Event	B_1	B_2	K_2
Dips	3.210633	1.642831	6.192785
Chins	4.731609	0.982467	4.643892
Dash	5.126835	1.874118	3.961439
Vault	5.003121	1.164310	5.721867
Standing Broad Jump	0.064152	2.891163	0.049199*
Leap Test	0.011056	3.196662	0.024837*
Running Broad Jump	0.162003	2.727335	0.197651*
Bar Snap	1.243978	2.160436	2.054734
Maze Run	2.340719	0.846293	2.973147

* Fulfill criteria for normalcy of distribution.

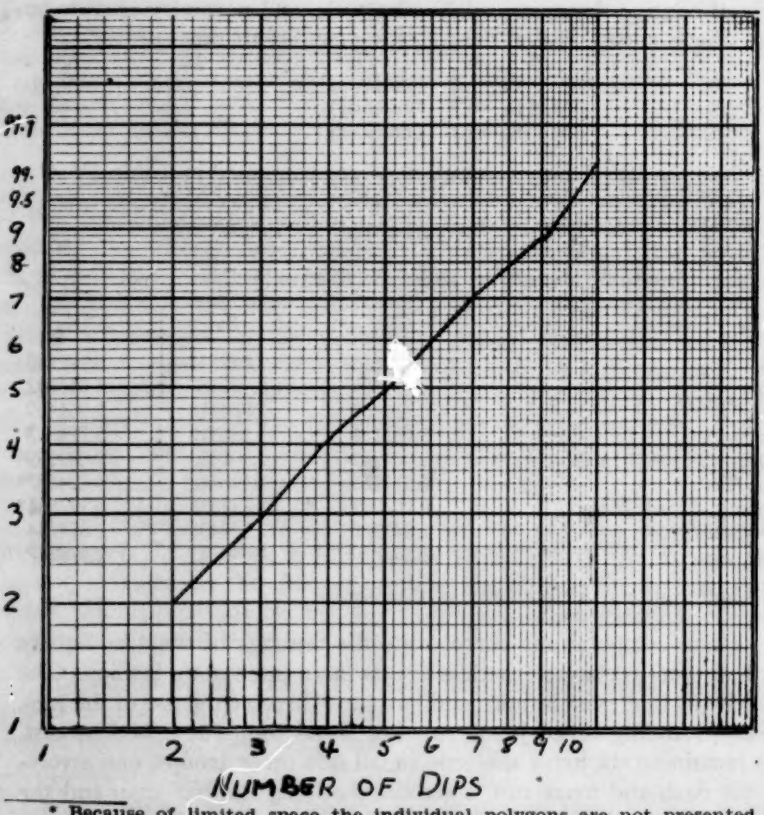
These computations corroborate the findings of the Chi Square test and tend to characterize the events in an interesting fashion. The three items that exist in normal distribution involve the use of the legs, namely, standing broad jump, running broad jump, and the leap test. The remaining six items also tend to fall into three groups, one involving the dash and maze run, a second involving the bar snap and the

[3] C. B. Davenport and M. P. Ekas. *Statistical Methods in Biology, Medicine, and Psychology.* New York: John Wiley and Sons, 1936, pp. 42-43.

bar vault, and the third involving dips and chins. Furthermore the events are categorized by the nature of the specific abilities underlying their performance. Standing broad jump, the leap test, and running broad jumps are events demanding sudden releases of power; the dash and the maze run are forms of speed and of speed involving agility; dips and chins are measures of strength; and finally, the bar snap and bar vault are items involving large muscle coordination.

The next step involved an analysis of the test items that were found to be skewed. This was done by plotting polygons and comparing by inspection the shapes of such graphs.* The one striking observation was that all polygons were positively skewed, although such occurrence is not surprising since negatively skewed curves are obtained very rarely.[4]

Data for the dips were then tested by using logarithmic probability paper; these results are shown in Figure I.



* Because of limited space the individual polygons are not presented in graphic form in the study.

[4]Croxton and Cowden, *op. cit.*, pp. 249-50.

FIGURE 1. LOGARITHMIC CURVE FOR DATA ON DIPS

CONCLUSIONS

1. Of the nine test items used in this study, the running broad jump, standing broad jump, and the leap test fulfill criteria for normalcy of distribution.

2. The remaining items, dash, maze run, chins, dips, bar vault, and bar snap, appear to be characteristically skewed to the right, or positively skewed. The question as to whether they obey an inherent law or whether they are skewed because of methods of administration still remains an unanswered problem.

3. The mathematical function that characterizes the normal curve is

$$Y_c = \frac{N_i}{\sigma\sqrt{2\pi}} e^{\frac{-x^2}{2\sigma^2}}$$

IMPLICATIONS OF THE FINDINGS

1. Assumptions of normalcy of distribution should be tested particularly in the case of constructing scoring tables based on skewed distributions.

2. At present two methods of constructing scoring tables appear to contain the most logical bases for such procedures: the method proposed by Bovard and Cozens[5] and the technique utilized by McCloy.[6]

3. One weakness of this study exists in the lack of determining the goodness of fit for the logarithmic curves. In view of the fact that such techniques were beyond the scope of the present study, however, it is suggested that another study be made along the same lines with the intention of confirming the evidence presented in this paper.

5J. F. Bovard and F. W. Cozens. *Tests and Measurements in Physical Education*. Philadelphia: W. B. Saunders and Company, 1938, pp. 317-34.

6C. H. McCloy. *The Measurement of Athletic Power*. New York: A. S. Barnes and Company, 932, pp. 19-37.

Research Abstracts

Prepared by
NATIONAL COUNCIL OF THE RESEARCH SECTION
GRANVILLE B. JOHNSON

BIOLOGY

Blum, Harold F., "The Physiological Effects of Sunlight on Man," *Physiological Review,* 28 (3) : 483-530, 4 fig., 1943.

The popular belief in sunshine as a cure for many ills is unfounded; only one of its direct effects on man is beneficial; life in complete darkness can be physiologically satisfactory if vitamin D is provided in the diet. The following phases of the subject are discussed: (1) physical effects (the spectrum of sunlight and penetration of sunlight into the human body), (2) physiological effect on the skin (sunburn, acquired immunity to sunburn, cancer, vitamin D, photosensitization, temperature effects, and others), (3) physiological systemic effects (the solar heat load, circulatory effects, metabolism and growth, endocrine systems, therapeutic action, heat stroke), (4) sunlight as a limiting environmental factor.—*Margaret Sunwalt.*

Coblentz, W. W., "The Measurement of Ultraviolet Radiation in Heliotherapy," *Journal of the Optical Society of America,* 36 (2) : 72-76, 3 fig., 1946.

The author has developed a Zr phototube responding only to wave lengths less than 3400 A, and gathering a hemisphere of radiation. With 4 filters of sharp ultraviolet cut-off the spectral composition, which varies with intervening air-mass, can be corrected. This meter integrates the ultraviolet energy coming from sun and entire sky. With it a physician can measure the ultraviolet dose for his patients. Photo-cells remaining constant in sensitivity should be developed and a primary standard set up at the National Bureau of Standards.—*R. R. Newell.*

HISTOLOGY

Gruenwald, Peter, "Embryonic and Postnatal Development of the Adrenal Cortex, Particularly the Znoa Glomerulosa and Accessory Nodules," *Anat. Rec.,* 95:4 (August, 1946).

The mesenchymal origin of the adrenal cortex is confirmed. The gland remains non-epithelial with the exception of the znoa glomerulosa which develops later. The retroperitoneal mesenchyme forms by differentiation in loco also accessory nodules and, in later periods, cortical cells in the adrenal capsule. The large units of the znoa glomerulosa of the newborn are replaced during childhood by narrow cell cords. Differentiation of new cortical cords in the capsule does not regularly occur in infants, but is frequently seen in older children and adults. Accessory cortical nodules near the adrenal capsule are very common in young children. They may grow by apposition before the main gland does. The frequent occurrences of much lipoid in the znoa glomerulosa is not fully explained by our present concept of morphology and function of the cortex.—*Wistar Institute.*

Hurme, Veikko O., "Old and New Concepts On the Structure of Dentin (a bibliographic note)," *Anat. Rec.,* 95:4 (August, 1946).

Partial corroboration of Nasmyth's unorthodox views on the structure of dentin has been furnished by three Swiss investigators, whose reports appeared during the war years. If confirmed by further research, the methods

employed by Grosjean, Perier, and Jaccard will lead to radical modifications of present-day concepts relating to the histology of calcified dental tissues. Using a metallographic technic for the study of opaque solids, these men failed to discover any tubules in dentin; instead, they obtained evidence which suggests that the tissue is similar to enamel in being composed of rods wih organic sheaths. The Swiss reports reveal unfamiliarity with Nasmyth's studies published a century ago. Anatomists have paid no attention to his main work, which is all but unknown even to bibliographers and dental historians. Nasmyth contended that the microscopic appearances of "ivory" (i.e., dentin) were consequent upon the manner in which the preparations were made. According to him the highly calcified "intertubular matrix" of dentin is neither intertubular nor structureless, but forms the bulk of solid, rod-like structures which present a "baccated" appearance after appropriate treatment with acid. The Swiss investigators, like Nasmyth, stress the need for undersanding the optical properties of dentin before drawing conclusions regarding its histologic characteristics. Whereas the former saw no special structures in the centers of the dentinal rods, Nasmyth thought that he saw "nuclei" there.—*Wistar Institute.*

ANATOMY

Schleicher, Emil M., "On the 'Conical Openings' in the Wall of Venous Sinusoids and Their Relations to the So-Called Erythrogenic Capillaries in the Bone Marrow of Man," *Anat. Rec.* 95:4 (August, 1946).

In non-infused and infused and serially sectioned human sternal marrow obtained during life, "conical openings" in the wall of venous sinusoids connecting so-called erythogenic capillaries with the general circulation were not observed. "Conical structures" were noted, however, which marked the union between "intraparenchymal sinuses" and "peripheral sinuses." The sides of these funnel-shaped structures were formed by fat cells, the top, when present, by a reticulum cell, and the floor or mouth was formed by the continuous wall of a venous sinusoid. The conical structures contained besides erythroid cells also myeloid elements and thrombocytes. Illustrations show an example of the "conical structures" and "intraparenchymal sinuses," a peripheral sinus and a venous sinusoid in bone marrow with fresh human blood plasma.—*Wistar Institute.*

Shah, M. A., and Mubarika Shah, "The Arterial Supply of the Vermiform Appendix," *Anat. Rec.* 95:4 (August, 1946).

From dissections performed on sixty cadavers (injection, red lead) some variation in the arterial supply to the appendix was brought out. It was found that in 30 percent of sixty specimens the appendix received two branches from either the anterior cecal artery or the posterior cecal artery or a branch from each of these two arteries.—*Wistar Institute.*

Sunderland, Sydney, and Edward S. Hughes, "Metrical and Non-Metrical Features of the Muscular Branches of the Ulnar Nerve," *J. Comp. Neur.* 85:1 (August, 1946).

As a necessary preliminary to a study of the order and rate of regeneration following lesions of the ulnar nerve, the shortest and longest distance to the muscles supplied by this nerve were measured from a fixed point along the nerve and its branches in twenty dissecting-room specimens. In addition to these measurements the shortest and longest distances from the medial humeral epicondyle to the origin of the most distal branch in each case are also given. The serial order of innervation of the muscles has been described on the basis of the shortest distance to each. In all but one specimen the flexor carpi ulnaris was supplied before the flexor digitorum profundus. In the hand the serial order of innervation varied considerably; these varia-

tions are described. In general, the hypothenar muscles were innervated first and of this group the abductor minimi digiti was usually the first to be supplied. The fourth, third, second, and first interossei were either innervated in that order or those of two or more adjoining spaces were innervated at equivalent distances. The abductor pollicis was supplied before or at the same distance as the first dorsal interosseous, rarely distal to it.—*Wistar Institute.*

Sunderland, Sydney, and Leslie J. Ray, "Metrical and Non-Metrical Features of the Muscular Branches of the Medial Nerve," *J. Comp. Neur.*, 85:2 (October, 1946).

As a necessary preliminary to a study of the order and rate of regeneration following lesions of the medial nerve, the shortest and longest distances to the muscles supplied by this nerve were measured, from a fixed point, along the nerve and its branches in twenty dissecting-room specimens. In addition to these measurements the shortest and longest distances from the medial humeral epicondyle to the origin of the first branch to each of the forearm muscles, and the distance to the origin of the most distal branch in each case are also given. The serial order of innervation of the muscles has been described on the basis of the shortest distance to each. This proved to be variable and information relating to the observed variations is provided. In general,, pronator teres was the first and pronator quadratus the last muscle supplied in the forearm. Flexor carpi radialis and flexor digitorum sublimis were innervated before flexor digitorum profundus and flexor pollicis longus. Flexor sublimis was supplied before or at the same level as flexor carpi radialis. Flexor profundus was supplied before flexor pollicis longus in seven specimens, at the same level in five, and below it in eight. The thenar muscles were innervated at approximately equivalent distances.—*Wistar Institute.*

Sunderland, Sydney, and Edward S. Hughes, "Metrical and Non-Metrical Features of the Muscular Branches of the Sciatic Nerve and Its Medial and Interal Popliteal Division," *J. Comp. Neur.*, 85:2 (October, 1946).

As a necessary preliminary to a study of the order and rate of regeneration following lesions of the sciatic nerve, the shortest and longest distances to the muscles supplied by this nerve and its medial and lateral popliteal divisions were measured, from a fixed point, along the nerve and its branches in twenty dissecting-room specimens. In addition to these measurements the shortest and longest distances from ischial tuberosity for the high muscles and the medial femoral epicondyle for the leg muscles to the origin of the first branch to each muscle and the distance to the origin of the most distal branch in each case are also given. The serial order of innervation of the muscles has been described on the basis of the shortest distance to each. This proved to be variable and information relating to the observed variations is provided. The results of this investigation do not lend themselves to summary. Reference should be made to the original paper for detailed information.—*Wistar Institute.*

NUTRITION

Consolazio, Frank C., and William H. Forbes, "The Effects of a High Fat Diet in a Temperature Environment," *J. Nutrition*, 32:2 (August, 1946).

Eight men subsisted for 9 days on a low-carbohydrate, high-fat food combination (a proposed emergency army ration) which provided 71 percent calories from beef fat, 27 percent from protein, and 2 percent from carbohydrate; the work done was moderate. Four controls ate an adequate diet 30 percent of the calories of which came from fat. Only one man could ingest an

adequate number of calories. Significant biochemical and physiological changes were (a) an average weight loss of 5.9 kg., some of this water; (b) change in water balance, with loss of body water; (c) salt depletion as measured by serum and urinary chlorides; (d) marked ketonuria; (e) change in glucose tolerance curve with prolongation of rise but no alteration to the maximum; (f) change in tolerance to a given dose of insulin with much increased physiological reaction and prolongation of the decrease without change of the minimum; (g) increased retention of bromsulfalein. All such changes disappeared after 3 days on a normal diet. Morale deteriorated on the diet; nauseating taste was an important factor. Nevertheless, scores in a physical fitness test remained practically constant. There were no significant changes in serum with respect to protein, N-N-N, ascorbic acid, cholesterol, and fasting glucose; and also with respect to urinary thiamine, riboflavin, ascorbic acid, basal metabolic rate, and phenolsulfonphthalein test of kidney function.—*Wistar Institute.*

Davis, Margaret, Helen G. Oldham, and Lydia J. Roberts, "Riboflavin Excretions of Young Women on Diets Containing Varying Levels of the B Vitamins," *J. Nutrition*, 32:2 (August, 1946).

The riboflavin excretion of young women on a diet in which the amount of the vitamin was progressively increased was followed during an 8-month period. From an initial intake during Periods 1-a and 1-b of 0.29 and 0.28 mg/1000 cal., the riboflavin level was increased by the addition of milk and by other dietary changes to 0.49 and 0.66 mg/1000 cal. during Periods II and III. In Period IV, which lasted 2 weeks, the total daily intake was 7.1 mg. During Period V, 3 weeks long, the intake averaged 0.63 mg/1000 cal.

Physical examinations at the beginning of the experiment and following Periods 1-a and 1-b revealed no signs of riboflavin deficiency. Daily urinary excretions "levelled off" within 10 days after each change in diet. Average daily excretions during the first four periods were 119, 107, 150, and 263 ug, respectively. Excretions rose sharply during supplementation, but after 2 weeks on a lower intake the average excretion was 325 ug.

Levels of fecal excretion of riboflavin differed considerably among individuals, but the amount excreted by each person remained relatively constant despite dietary variations.

Test dose returns at the end of Periods 1-a and 1-b averaged 2.8 and 4.5 percent. With increased intake in Periods II and III, the average returns were raised to 11.8 percent and 14.3 percent, respectively. Test dose returns were not increased by supplementation, the average at the end of Period V being 15.6 percent.—*Wistar Institute.*

Oldham, Helen G., Margaret V. Davis, and Lydia J. Roberts, "Thiamine Excretions and Blood Levels of Young Woman on Diets Containing Varying Levels of the B Vitamins, With Some Observations on Niacin and Pantothenic Acid," *J. Nutrition* 32:2 (August, 1946).

Daily urinary and fecal thiamine excretions, test dose returns, blood thiamines, and 1-hour fasting thiamine excretions of twelve women were determined on various levels of intake over a period of 8 months. Intakes of 0.14, 0.20, and 0.36 mg per 1000 cal. were judged to be inadequate on the basis of urinary excretions and test dose returns. On an intake of 0.51 mg. per 1000 cal. the excretions increased somewhat but still remained low. That the tissues were not saturated at this level was further indicated by the facts that (1) during subsequent supplementation the excretions were higher during the last 3 days than during the first 3; and (2) in the final period, on an intake similar to that previous to supplementation, both daily urinary ex-

cretions and test dose returns showed increases. It is suggested that the total daily thiamine intake should probably not be less than 1 mg or 20 ug per kg of body weight.

Fecal thiamine excretions for different individuals were relatively constant throughout the study. Average daily urinary and fecal excretions of niacin also remained relatively constant at approximately 1.0 mg. each, regardless of the levels of intake. Total excretions of pantothenic acid closely approximated the intakes at each level, by far the larger proportion being excreted in the urine.—*Wistar Institute.*

PHYSICAL EDUCATION

Armbruster, David A., "Teaching Swimming Faster by Means of Artificial Supports." *Journal of Physical Education,* 42:6 (July-August, 1945).

Experiments in teaching large groups of persons to swim have convinced the author that the use of artificial supports has great advantages. He uses a simple, inexpensive, "home-made" can float attached to the student by a cloth belt two inches wide. This method, he feels, is good pedagogy because it enables the students to swim in a minimum of time by quickly passing them through the initial unpleasantness of the orientation phases and into the more pleasant sensation of swimming. Usual objections to the use of supports are (1) they are a form of crutch—once used they are difficult to discard, (2) some are dangerous, (3) most are expensive and unsanitary. Armbruster feels he has met all three objections, that his method gets the beginner into immediate action thus preventing chilling. It gives a feeling of security and allows the student to "over-learn" skill movements by more prolonged stroke practice. He is also taught proper breathing habits while being supported in the water. It is a plan proposed for use by all University of Iowa students.—*H. T. Friermood.*

Carey, V. M., "El Paso Co-ed Club," *Journal of Physical Education,* 42:5 (Sept.-Oct., 1945).

A documented experience reveals processes used in developing a small YMCA boys' high school leaders' club into a city-wide co-ed club of 1,300 members during the course of three years. Club officers were equally divided between boys and girls. Service projects were carried on. Adult interest was secured. Half of the finances were secured through moderate club fees. Daily life problems formed the basis of club programs and discussion. Returned veterans were used frequently as leaders in many of the discussions. Gymnastic exhibitions by both boy and girl club members were undertaken. Co-ed parties and camping trips with good leadership helped to develop excellent boy-girl relationships. A community-wide influence resulted by bringing representatives from the five city high schools into this co-ed club membership and fellowship.—*H. T. Friermood.*

Harding, A. Merl, "The Two-way Physical Education Department," *Journal of Physical Education,* 42:5 (May-June, 1945).

This is a concise description of what is called "The Recreation-Way" and the "Directed-Training Way" of conducting a YMCA department of physical education. In the former, physical examinations and physical fitness tests are optional, but they are required in the latter plan. In the former plan, free choice is allowed with instruction, coaching, and recreational participation provided. Scheduled game periods, leagues, and representative team competition also are planned. In the "Directed-Training Way" members' programs are planned during interviews following examinations and testing. Each is assigned for special instruction or class work. Each is scheduled for periodic interviews and retests with program modifications made as indicated. The

former plan makes much use of volunteer leadership. The latter plan, while using volunteer leadership, requires well trained professional direction.—*H. T. Friermood.*

Kistler, Harold, "New York's Experience with Returned Servicemen," *Journal of Physical Education,* 42:4 (March-April, 1945).

An analysis of veterans' activity interests, attitudes, and participation made by Kistler showed that veterans expect higher quality equipment now than prior to the war, due to wartime training experiences. They want to participate rather than be spectators. They have a better understanding of balanced diets. They expect more co-ed activity programs. They want more outdoor life. Former YMCA members return to their former program interests. The best methods of assimilation seem to be to provide a wide variety of activities to choose from, and have a group of participants organized in each activity into which veterans may enter. The greatest factor in "getting started" is friendship.—*H. T. Friermood.*

Nelms, Lt. A. Jr., "Physical Training Program at Camp Robinson, Arkansas," *Journal of Physical Education,* 42:4 (March-April, 1945).

Three important factors of this program are youth, home-made equipment, and hard work. Elements of the program can be used for peacetime high school (and college) fitness programs and successful adaptations have been made for girls' schools. At Camp Robinson 4,000 men per hour were put through this daily health and body-building program. A plan of supervision was instituted to prevent undue strain, to develop progression, and to provide continuous motivation. The excellent results obained were secured through five courses, each one designed to secure the quality indicated by the name: (1) "Strength" (barbell, jump rope, grip twist, Roman chair, war club, bicycle ride, chinning bar, posture wall); (2) "Confidence" (36 numbered obstacles); (3) "Toughness" (heavy logs); (4) "Aggressiveness" (sawdust pit); (5) "Endurance" (mile run).—*H. T. Friermood.*

Stearns, Archie, "The YMCA Physical Director—What Makes Him Tick," *Journal of Physical Education,* 42:5 (May-June, 1945).

This is a practical philosophical discussion of the qualities required in a good YMCA physical director by a man who has been studying the problem for 20 years. He (the YMCA physical director) must have good character. He must accept his full share of civic duties. His professional training must be broad and basic to begin with and continue throughout his professional career. He needs to develop a personality that attracts and inspires people. Good common sense and mature judgment, are necessary qualities. Whether he likes it or not he must be an example of the things he teaches in health and fitness and what he preaches in Christian living. He must have organizing ability and work effectively through and with the Physical Department Committee, the Sports Council, volunteer leaders' clubs, and other groups. He must develop the ability to write clearly and speak in public. The program must be planned and presented in many ways, but with the good, essential fundamentals of variety, progression, adaptation to needs, interests, and effective promotion methods.—*H. T. Friermood.*

Whitmore, J. S., "Results of Industrial Survey," *Journal of Physical Education,* 43:1 (Sept.-Oct. 1945).

One hundred and two questionnaires dealing with YMCA industrial recreation programs were mailed and 72 were returned from all parts of the United States and Canada. The replies indicated the general approach to young men in industry seemed to be through recreational and athletic programs. Thirty-seven Associations conduct leagues in their buildings, 23, in

other places in the community. Nineteen hold regular "plant nights" in their buildings, 14 more occasionally have such events. Thirty-six conduct gym classes or recreational periods; some of these were for "swing-shift" workers. Forty-one associations reported having an industrial work committee; 35 had a special industrial work YMCA secretary. Women participate in bowling, badminton, splash parties, softball, and tennis, as well as in social activities. Forty-five YMCA's financed their programs through regular membership fees; five, by special appropriations, eight, by management appropriations, some, through team entry fees. A final section of the report points out the need for good organization with effective representation on a central planning board. Companies and players need to be governed by definite and mutually agreeable policies. Good committee service should operate at all levels of planning. No special privileges should be given by management to athletic participants. Many YMCA's have given long leadership to community-wide industrial recreation planning and constructive programs.—*H. T. Friermood.*

EDUCATION

Major, C. L., "Measuring the Effects of a Semester of College Work on the Conservative-Progressive Tendencies of Students," *School and Society*, 64:1654, pp. 174-175 (Sept., 1945).

A test of 79 items on conservative-progressive tendencies developed by Raup, Williamson, and Peterson was administered to a class of 25 students (sophomores and juniors) at Dennison College. The test items were in relation to seven contrasting categories: (1) static-dynamic, (2) academic direct, (3) scientific-philosophical, (4) individual-social, (5) hereditary environment, (6) passive-active, (7) separate mind-naturalistic view. The test was scored in reference to the seven categories and also indicated students' convictions.

The test was administered in September and again in January. No common pattern of class work was taken by the students. One class, Introduction to Education, was taken by all. Otherwise the students took 60 separate courses in 18 different departments in the university. The January testing revealed a swing toward progressive points of view, 3.3 percent over the September score. There was a loss in personal conviction, 9.1 percent loss. The other results were of no particular significance.—*Carolyn W. Bookwalter.*

Dinkel, Robert M., "Factors Underlying the Location of Physicians Within Indiana," *American Sociological Review*, 11:1, pp. 16-25 (Feb., 1946).

A questionnaire of 22 items was prepared with the instruction that each be checked as to whether or not it had been important in the selection of the doctor's current location. It was mailed in December, 1941, to 125 rural and 250 urban physicians listed in the 1940 Indiana Medical Directory as having been graduated in 1920 or later and who were not connected with a staff of an institution or a university.

Of the questionnaires returned, 154 were from urban and 66 from rural physicians. Social and economic factors were considered important factors in locations of practices. Thirty-six percent (urban) and 17 percent (rural) checked the joining of an older doctor as having been important. "Home town" as a reason was checked by 43 percent (urban) and 14 percent (rural). Good schools, churches, and institutions were reasons checked by 47 percent (urban) and 59 percent (rural). The accessibility to good hospital facilities was checked by 69 percent (urban) and 53 percent (rural).—*Carolyn W. Bookwalter.*

Hirschfeld, Gerhard, and Carl W. Strow, "Comparative Health Factors Among the States," *American Sociological Review*, 2:1 pp. 42-52 (Feb., 1946).

The material was compiled and health indices were set up within seven major categories: (1) population—total, urban, large families, non-white population, and aged persons; (2) mortality rates and draft rejections—infant deaths, death rates from heart disease, tuberculosis, infectious and contagious diseases, and draft rejections; (3) sanitation—dwelling units without sewerage connections and dwelling units in need of major repairs; (4) medical facilities—physicians, dentists, nurses, hospital beds, and health expenditures; (5) health insurance—health and accident (casualty) insurance, prepaid medical care, and Blue Cross prepaid hospitalization; (6) economic resources—wealth, income, and savings; and (7) culture—illiteracy, high school enrollment, school expenditures, expenditures for recreation, and professional persons in the labor force.

Statistics for 1940 were used. The data for sanitation were found to be of little value due to the difference in the regulations for urban and rural states. Likewise the health insurance data were of little value. Of the total population 56.5 percent are urban. Rhode Island is the most urban state with North Dakota being the most rural. Highest rates of infant mortality were found in the south and southwest. Most of the deaths (72 percent) took place at 60 or more years of age. New England has the highest rate of aged and longevity. Infectious and contagious diseases, including tuberculosis, are higher in the southern and southwestern states. The southern and southwestern states are the most deficient in economic ability. The southern states are the most underprivileged in medical facilities having 1,300-1,500 persons per physician, 500-1,100 per nurse, 300-700 per hospital bed, and 300-5,300 per dentist. The most advantaged states have one-half to one-third of such ratios. When compared with the standard ratio 1,000 per physician, 2,000 per dentist, and 250 per hospital bed, there appears to be a great handicap to the promotion of good health in the southern states.

The most advantaged states had the lowest draft rejections. High rejections correlate positively with illiteracy and non-white population elements. High positive correlation of economic and cultural strength with good health proves the importance of those forces. Seven out of the twelve most advantaged states (northern and located from coast to coast) are highly industrialized and urbanized.—*Carolyn W. Bookwalter.*

Book Review

Rehabilitation: Its Principles and Practice. (Rev.) John E. Davis. New York City 18: A. S. Barnes and Co., 67 West 44th St., 1946. 260 pages, $3.00.

This book describes pragmatic procedure provided for psychiatrists and the public as an aid to the mentally ill. It is a volume that will prove of value to educators and rehabilitation specialists generally. As a result of a quarter of a century of progressive educational experience, observation, and research with some of the most difficult problems in rehabilitation work, the author has promulgated one of the most practical aids in approaching the treatment of those who have materially deviated from the normal path of conduct and thought.

Dr. Davis has used the best psychiatric and empirical approach to the problem by use of recall of early childhood games and pastimes of the client, with the attendant return to any possible pleasant associations of earlier life, and with the development of interest in participation. In a short time he is able to arouse a competitive spirit to the exclusion of introversion, with eventual recovery for some of the most difficult cases.

By development of sports and games he endeavors to bring about a receptive attitude on the part of the client toward psychotherapy, a vicarious approach to the problem of the psychiatrist as well as a material aid in bringing out many facts of earlier importance in the life of the client.

Of immense value to the reader of this book is the psychological approach in Chapter III. Supplementing general, medical, and psychiatric examinations by specialists, information is presented about various objective tests of mental ability, manual dexterity, mechanical aptitudes, and personality evaluations, including the Rorschach method used by Lt. Colonel Douglas M. Kelly who until recently was the chief psychiatrist in the Nuernberg trials of Goering, von Ribbentrop, Hess, and other Nazi criminals with distorted personalities.

Dr. Davis has presented a useful method of approaching the many problems that are being presented in the daily lives of people of all groups and in all communities, not only in the remission but also in the prevention of mental and emotional aberration. There are many problems of direct significance to research in physical education in its relationship to mental health in this integration of the psychological and the psychiatric approach to one of the most momentous aspects of future civilization.

Judson W. Jones
Vocational Examiner
Newark, New Jersey

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1943

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1946

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2. Papers are not judged by arbitrary standards of length but on their content of new research results in the field of physical education, health education, and recreation, presented with the greatest brevity compatible with scientific accuracy and clarity.

3. Since manuscripts will not be insured against loss or damage, authors are expected to retain duplicate copies of all material submitted.

4. An original typewritten copy of the manuscript should be submitted. The content should be double spaced with a margin of 1½ inches on each side.

5. The author may include either a list of references at the end of the article or he may put them in footnotes or these two methods may be combined. Book publishers and periodicals do not always agree on the exact order of details in the preparation of references. Also, authors do not always include all the necessary information in references. For authors who have not published extensively a simplified form of magazine and book reference is shown. If a formal bibliography is included with the paper a simple footnote may be used as shown:[1]

1 Katherine B. Crisp, *Health for You*, p. 520.

In this case the footnotes are placed on each page and the bibliography is set up alphabetically and placed at the end of the article. The latter should show the facts of publication, i.e., edition if any, place published, publisher, date.[2,3]

2 Stern, Francis. *Applied Dietetics*. Baltimore, Md.: Williams and Wilkins Co., 1943. (form for book reference in a bibliography)

3 Corbin, H. D., "Current Problems in Recreation," *Journal of Health and Physical Education*, 15:6 (June, 1944). (form for magazine reference in a bibliography)

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4 Kraines, S. H., and E. S. Thetford. *Managing Your Mind*. New York: The Macmillan Co., 1944.

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Index to Volume XVII (1946)

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Numbers refer to number of issue first and page number second. For example, 2:96 refers to May, page 96. Number 1 is March; number 2, May; number 3, October; number 4, December. No supplements to Volume XVII were published.